

NASA Challenge Pavilion Results



Evaluation of the Open Innovation Pilot Program between NASA and InnoCentive, Inc.

Proprietary and confidential

Dedicated NASA Pavilion on InnoCentive.com

- *Established in 2009*
- *Dedicated to NASA Challenges for no additional cost*
- *Received over 50,000 visits*



Link to the Open Government Directive

- **Transparency:** Through these Challenges NASA conducted its work more openly and made information openly available online.
- **Public Participation:** NASA promoted opportunities for the public to participate in solving complex problems.
- **Collaboration:** NASA used the technology platform of InnoCentive to engage the public and provided an opportunity for a collaborative engagement not available through traditional procurement vehicles.

NASA Pavilion Challenges – Phase 1 (2009)



“Keeping Food Fresh in Space”

Award: \$15,000



Expertise: Material Sciences
Solutions: 22
Countries: 10



Awarded



“Aerobic Resistive Exercise Device ”

Award: \$20,000



Expertise: Engineering
Solutions: 95
Countries: 24



Awarded



“Data-Driven Forecasting of SPEs”

Award: \$30,000



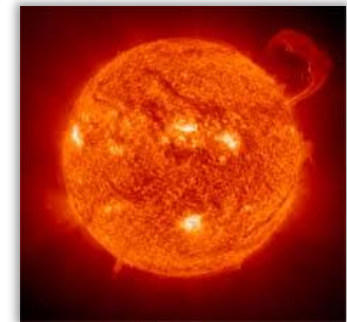
Expertise: Big Data
Solutions: 11
Countries: 5



Awarded

Data Driven Forecasting of Solar Events

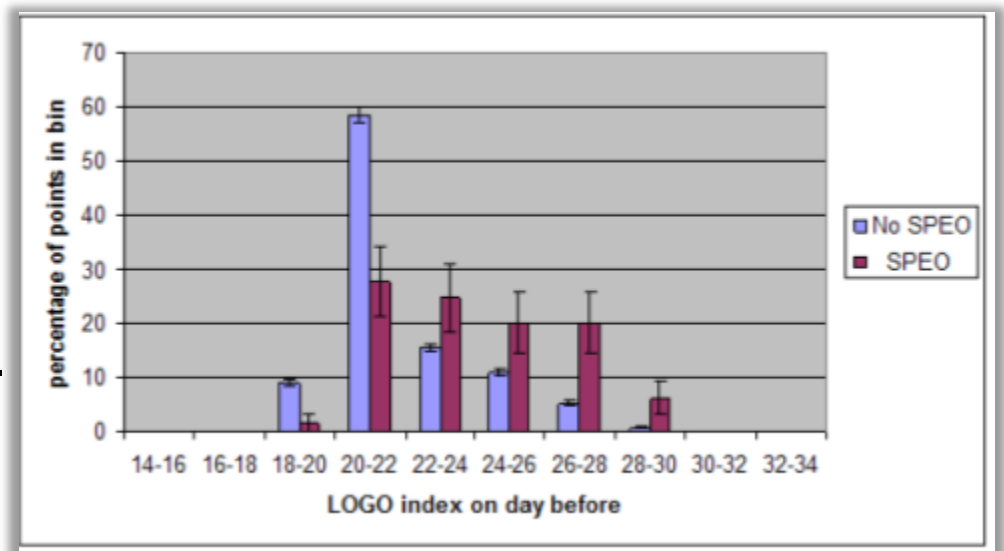
- **The Challenge:** Leverage 35 years worth of extensive data and build a predictive model based on any sort of predictive signature or precursor events that may lead to better prediction of an SPE onset.
- **Why:** NASA wanted to better forecast the occurrence of a Solar Particle Event (SPE) within a select time window. SPEs can dramatically affect infrastructure (e.g., power grids, communications) as well as astronauts working in space.



The Results:

- 579 Solvers from 53 Countries
- Solution Found: Winner improved predictability of from 4 hours to 8 hours with 85% predictability.
- A full \$30,000 award was made to retired Ph.D. from New Hampshire for his SPE prediction algorithm.

The winning Submission was fourteen pages of written explanation complete with the **algorithm and data results**; spreadsheet containing the validation and all referenced data.



Challenge Owner Response

“The submission was very thorough. It addresses the challenge requirements and exceeds them with respect to forecast confidence and to random prediction. Questions posed back to the Solver were thoroughly addressed. This solution holds promise and the Seeker is highly interested in working with the Solver on potential implementation into an operational framework.”

Dr. Dan Fry, Scientist, Space Radiation Analysis Group

The Human Interest Story



Bruce Cragin, academic background is in engineering and applied physics (B.S. Cornell, Ph.D. UCSD). Started his career as a research scientist specializing in waves and in plasma instabilities.

In 1997 he changed careers to radio engineering, most recently, with Sprint Nextel Communications, provided the winning submission.

“Though I hadn’t worked in the area of solar physics as such, I had thought a lot about the theory of magnetic reconnection.”

The Impact

- **Impact:** Like predicting earthquakes, tsunamis and financial crises, predicting SPEs is very complex. The solution uncovered a new heliophysics model to find a signal that predicts energetic particle events.
- **Next step:** With the right resources, this innovation will be a key component of an overall predictive pipeline for solar weather and events.

“This finding is an important new lead to enable long-duration human spaceflight”

– Dr. Jeffrey R. Davis, Director of Space Life Sciences

Public Announcement



Challenge: Identification of a better forecasting model for solar activity to protect astronauts and satellites in space

Award: \$30,000

Winner: Bruce Cragin, a Retired Ph.D. from New Hampshire. The solution exceeded requirements.

Announced by Aneesh Chopra, US CTO at 2010 in NYC.

NASA Pavilion Challenges – Phase 2 (2010)



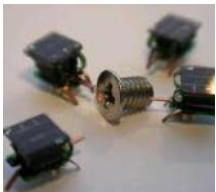
“Medical Consumables Tracking”
Award: \$15,000



Expertise: Process / Engineering
Solutions: 56
Countries: 16



Awarded



“Coordination of Sensor Swarms”
Award: \$20,000



Expertise: Biology / Theory
Solutions: 37
Countries: 11



Awarded



“Simple Microgravity Laundry”
Award: \$25,000



Expertise: Engineering
Solutions: 108
Countries: 20



Awarded



“Augmenting the Exercise Experience”
Award: \$20,000



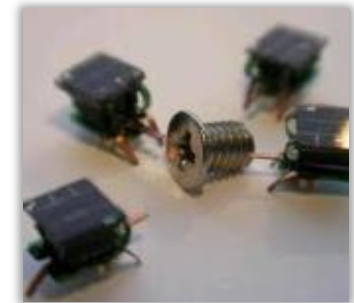
Expertise: Systems / Virtual Reality
Solutions: 18
Countries: 9



Awarded

Coordination of Sensor Swarms

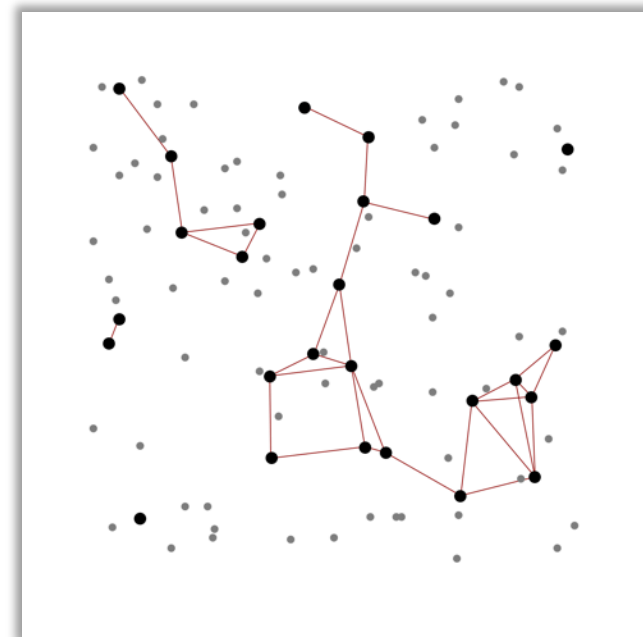
- **The Challenge:** Build and Describe a protocol for how simple sensors communicate information amongst themselves and make decisions about what to measure on the fly and where to go if locomotion is possible.
- **Why:** Through better understanding of swarming behavior (drawn upon nature), this creating of “intelligence” distributed within the swarm would allow for better collected data with no single point of failure.



The Results:

- 423 Solvers from 49 Countries
- Solutions Found: Partial awards made to three (3) Solvers for their algorithms, engineering analysis and comprehensive description of swarm activities.

An interesting concept presented; the **Game-Theory communications** algorithm: 'learning what your neighbors are doing'. It would be interesting to learn more about this algorithm and the expansion of the concept to areas such as data sharing and decision making.



Challenge Owner Response

“The qualitative value gained in this process is having 3 new contacts to work with once the solver verification packs are completed. Finding 3 knowledgeable resources is of value to the future of the program.”

Erik Vedeler , Branch Head Electromagnetics and Sensors at NASA Langley Research Center

The Human Interest Story



Tad Hogg is a Behavioral and Nanotechnology research fellow at the Institute for Molecular Manufacturing who designs, evaluates and models large human and distributed computational systems by relating aggregated performance to their component behaviors.

With a PhD. In Physics from Stanford University, Tad is uniquely prepared mind to work on this complex problem for NASA.

“As a frequent participant and fortunate winner of several InnoCentive Challenges, I was excited to apply my experience and capabilities to help the most fascinating organization in the world, NASA.”

The Impact

- **Impact:** The Challenge and solutions obtained provided advocacy and influence on the swarming discussion and potential applications within the agency.
- **Next step:** Until this becomes part of a funded project, the next steps are furthering the research and discussion on applications for NASA aerospace problems.

“There was a lot learned for the time and money spent - worth it.”

– **Melvin Ferebee** – NASA LRC, Participatory Exploration

NASA Program Results and Lessons Learned

NASA Challenge Program Reach

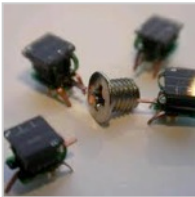


2,932 Solvers from 62 Countries Engaged

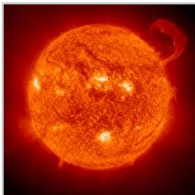
InnoCentive Delivers Solutions...



Keeping Food Fresh in Space
Awarded



Coordination of Sensor Swarms
Awarded



Data-Driven Forecasting of Solar Events
Awarded



Augmenting the Exercise Experience with A/V Inputs
Awarded



Medical Consumables Tracking
Awarded



Simple Microgravity Laundry System
Awarded



Mechanism for a Compact Aerobic and Resistive Exercise Device
Awarded



...Faster & More Cost Effectively

- **Average time to solution 8 months vs. 12 months**
- **Solution costs averaged 50% of comparable projects**

Measurable Benefits Found

Measured Benefit Item	Calculation
Awarded Solution Value	Summary of the acquired value of the awarded solutions
Diverse Solvers and Process Value	Access to an expanded expert network Pay only for Performance
Reduced Internal Resource Burden	Promotes effective use of established resources

Qualitative Benefits Found

Qualitative Benefit Item	Calculation
Identify Future Collaborators	New contacts and resources identified with winning solvers
Improved Research Process	Enhanced ability to frame research needs Challenge definition skills
Fostering Cultural Change	Move from NIH to PFE Ability to fail fast

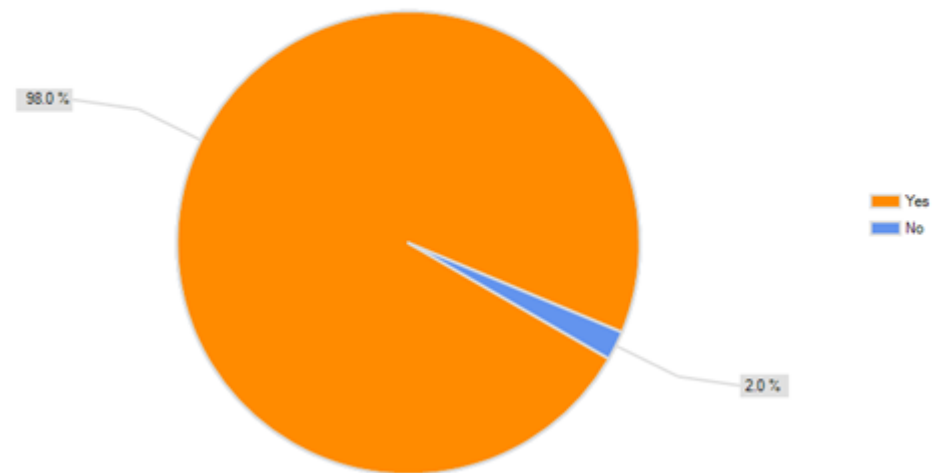
Lessons Learned – NASA Challenge Owners

- The concept that you can go outside of NASA and receive **valuable information** from non-related people has been **validated**.
- Collaborative innovation is more unique than we thought, having **expert help to design and manage your program** is extremely important.
- You must **manage your expectations about external solutions**, they don't look like something from NASA; but this is the value of the program.
- To avoid receiving solutions already known, you should **identify undesirable technologies** in your Challenge.

Solvers Survey

- 98% of Solvers would work on more NASA Challenges.
- The Challenge and opportunities to make an impact resonate more with Solver's motivations than financial award.

Are you interested in working on more NASA challenges?



(September 2010 NASA survey)

Thank You!
Questions?

Contact me directly:

Steven Domeck

513-767-7472

sdomeck@innocentive.com

